Notice of Allowability	Application No.	Applicant(s)	
	10/626,887	LENTZ ET AL.	
	Examiner	Art Unit	
	Richard L. Leung	3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment filed 14 April 2005 and Examiner's amendment*.

2. ☒ The allowed claim(s) is/are *1,2,4-6,8-10,12-16 and 18-20*.

3. ☒ The drawings filed on *12 April 2004* are accepted by the Examiner.

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☒ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date 2-4-05; 4-21-05
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Neil Nydegger on 24 June 2005.

The application has been amended as follows:

Claim 1 (currently amended) A heat transfer system which comprises:

a hollow supply tube having a proximal end and a distal end;

a capillary tube having a proximal end and a distal end with the proximal end thereof connected in fluid communication with the distal end of said supply tube, said capillary tube being formed with a lumen having a length "l" and a diameter "d";

a tip member positioned to surround the distal end of said capillary tube to create a cryo-chamber therebetween; and

a source of refrigerant fluid connected in fluid communication with the proximal end of the supply tube to introduce the refrigerant fluid into the supply tube wherein said fluid refrigerant has been pre-cooled to approximately -45°C at a working pressure "p_w" of approximately 400 psia for transfer of the refrigerant fluid through said supply tube and through said capillary tube for exit from the distal end of said capillary tube and into said cryo-chamber in a substantially liquid state for transition of the refrigerant fluid into

a gaseous state with a tip pressure "p_t" and a tip temperature "T_t" for heat transfer through said tip member and into the gaseous fluid refrigerant in said cryo-chamber[[.]];

wherein an aspect ratio "d/l" for the capillary tube is in a range of 0.0008 to 0.0017.

Claim 3 (canceled).

Claim 4 (currently amended) A system as recited in claim [[3]] 1 wherein the length "l" of said capillary tube is in a range between approximately four and one half inches and approximately ten inches.

Claim 10 (currently amended) A heat transfer system which comprises:

a means for providing fluid refrigerant;

a means for cooling the fluid refrigerant to approximately -45°C at a first pressure of approximately 400 psia to transform said fluid refrigerant into a liquid state;

a means for reducing the pressure on the liquid refrigerant from the first pressure to a second pressure; and

a means for introducing the liquid refrigerant into a cryo-chamber at the second pressure for transition of the liquid refrigerant into a gaseous state in the cryo-chamber to cause heat to transfer from outside the cryo-chamber and into the cryo-chamber[[.]];

wherein said reducing means comprises:

a hollow supply tube having a proximal end and a distal end; and

a capillary tube having a proximal end and a distal end with the proximal end thereof connected in fluid communication with the distal end of said supply tube, said capillary tube being formed with a lumen having a length "l" and a

diameter "d" wherein an aspect ratio "d/l" for the capillary tube is in a range of 0.0008 to 0.0017.

Claim 11 (canceled).

Claim 12 (currently amended) A system as recited in claim [[11]] 10 wherein the length "l" of said capillary tube is in a range between approximately four and one half inches and approximately ten inches and the diameter "d" of said capillary tube is in a range between approximately 0.008 inches and approximately 0.010 inches.

Claim 16 (currently amended) A method for transferring heat which comprises the steps of:

providing a fluid refrigerant;

cooling said fluid refrigerant to approximately -45°C at a first pressure of approximately 400 psia to transform said fluid refrigerant into a liquid state;

reducing the pressure on the liquid refrigerant from the first pressure to a second pressure; and

introducing the liquid refrigerant into a cryo-chamber at the second pressure for transition of the liquid refrigerant into a gaseous state in the cryo-chamber to cause a transfer of heat outside the cryo-chamber and into the cryo-chamber[[.]];

wherein said reducing step comprises the steps of:

advancing the liquid refrigerant through a hollow supply tube to a capillary tube having a proximal end and a distal end; and

causing the liquid refrigerant to flow through the lumen of the capillary tube wherein the lumen of the capillary tube has a length "l" and a diameter "d" with an aspect ratio "d/l" for the capillary tube in a range of 0.0008 to 0.0017.

Claim 17 (canceled).

Claim 18 (currently amended) A method as recited in claim [[17]] 16 wherein the length "l" of said capillary tube is in a range between approximately four and one half inches and approximately ten inches and the diameter "d" of said capillary tube is in a range between approximately 0.008 inches and approximately 0.010 inches.

The following claims have been renumbered:

Claims 4-6 have been renumbered 3-5, respectively.

Claims 8-10 have been renumbered 6-8, respectively.

Claims 12-16 have been renumbered 9-13, respectively.

Claims 18-20 have been renumbered 14-16, respectively.

2. The following is an examiner's statement of reasons for allowance: a search of the prior art did not reveal any references, either alone or in an obvious combination, that demonstrate all the recited limitations presented in the amended independent claims. While the cited prior art disclose various heat transfer systems and methods that are considered relevant to the present invention, there is no clear teaching or strong suggestion in the prior art of a system or method wherein a fluid refrigerant is specifically cooled to approximately -45°C at a pressure of approximately 400 psia to

transform the refrigerant into a liquid, wherein the pressure of the liquid refrigerant is subsequently reduced by means comprising a supply tube and a capillary tube having a particular diameter/length ratio in a range of 0.0008 to 0.0017, and wherein the refrigerant is introduced into a cryo-chamber in a substantially liquid state, as recited in the amended independent claims. Accordingly, the claims are considered allowable over the cited prior art.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5502972 (Howard et al.): discloses a refrigerant system wherein a refrigerant vapor is compressed to 300-450 psia, condensed through cooling to about -45°C, subsequently expanded by a pressure reducing means, and introduced to a cryo-chamber for transferring heat.

US 5520682 (Baust et al.): discloses a cryoprobe comprising a flow of cryogenic refrigerant through a supply tube followed by flow through a second tube of smaller dimensions.

US 2002/0120258 A1 (Lalonde): discloses a heat transfer system comprising a refrigerant source and supply tube wherein a refrigerant is supplied at about 400 psia.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard L. Leung whose telephone number is 571-272-4811. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl J. Tyler can be reached on 571-272-4834. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Richard L. Leung
Examiner
Art Unit 3744

CHERYL TYLER
SUPERVISORY PATENT EXAMINER

rll